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THE MICROCLIMATE OF A CITY AS AN OBJECT OF HYGIENIC RESEARCH

B. V. Rikhter

A new problem has arisen in climatology -- the problem of microclimate. This is the clearly marked climatic deviation of a specific area in comparison to the general climatic condition of a given zone. For example, the climate of a city may be different from that of the surrounding area.

Factors affecting microclimate are those surface conditions which are sharply distinguished by their physical characteristics from the surrounding geographic zone. For example, a wood in the midst of a steppe zone, relief changes in the midst of a plain, water basins, etc.

Microclimate is, at present, a very complex question and is of interest to such representatives of various special fields as agronomists, forest rangers, hydraulic engineers, builders, architects, doctors, and, especially, hygienists. Strange as it may seem, climatologists and meteorologists are the least active in the study of this problem. However, various specialists, each in his own field, are studying this problem.

In the absence of a general methodology, one should not as yet expect any great success from these investigations. The results obtained from comparisons and generalizations cannot be applied. This situation is particularly exasperating to the hygienists who are concerned with sanitation problems especially concerning cities.

Since microclimate influences man and his activity, the hygienist must have a clear view of the microclimatic conditions under which the populations of these particular areas live. The study of the microclimate of a city is especially important. Present-day cities and, particularly, large industrial centers -- the working and dwelling places of a large mass of people -- always have greatly different physical conditions than the surrounding natural zone.

Today the possibility exists of breaking a city down into various sectors each with its own microzone and its own micrometeorological characteristics.

The climate of a natural geographic zone can be considered as a macroform; that of the city characterized by a general deviation of climatic elements, a microform. Special research on the influence of the city on the course of meteorological factors has confirmed the accuracy of these advanced theories. In the USSR, old cities are growing and new cities are springing up at an increasing tempo accompanied by an increase in the urban population. New and specific living and working conditions are coming into existence. Comprehensive investigations of living and working conditions in a large city are a high-priority task for hygienists. The hygienist must have exhaustive and reliable data on the general climatic characteristics of a large city and on its microclimatic peculiarities.

Such data on the climatic characteristics of a big city should clarify the following points:

1. Determine the deviation in the course in each meteorological element in comparison to the natural zone.

2. Explain the cause of these deviations.

3. Define the changes in each of the climatic elements and the distribution of these changes in the city's atmosphere.

4. Determine the influence of the city's climate on the population.

5. Evaluate the influence of the city's climate upon hygienic conditions.

6. Determine the possibility of meliorative intervention and establish medicohygienic standards for the melioration of the city's climate.

All investigations carried out under urban conditions show that, under the influence of urban conditions, any meteorological factor changes to some degree with respect to the surrounding locality. But there are still no dependable conclusions on these changes with respect to a city and its environs or with respect to time, i.e., the natural seasons of the year.

The process of collection and generalization of these materials demands a special method, not only to indicate the influence of the city on climate but also to indicate how these changes will affect the living and working conditions of the urban residents in comparison to those in natural climatic condition.

If we accept the fact that initial conditions of climate formation are: (1) the effect of solar energy on the earth's surface, (2) the processes of atmospheric circulation, (3) the condition of lower atmospheric strata, and (4) the influence of the underlying surface, then the final component of this scheme will be the city.

The influence of the city as an underlying surface is profoundly distinguished from the usual definition of this factor. An urban landscape is the artificial creation of man's economic activity, profoundly distinguished from the natural geographic and surrounding landscape. Its soil, form, relief, and vegetation have been changed. In addition, the urban landscape acts on its environs and correspondingly on the strata of the atmosphere which are contiguous to it.

Since the activity of the city's population serves as a source of energy, the final analysis can be transformed chiefly into thermal and partly into chemical-electrical energy. It must be considered that the activity of the urban landscape must prevail in the evaluation of all other physical phenomena of this underlying surface and that this brings about changes in the condition of the lower strata of the city's atmosphere which we did not find in the same geographical conditions beyond the city limits.

Such a condition causes a change even in the transformation process of air masses which flow in the lower strata of the atmosphere. Therefore, the third factor, which is the lower strata of the atmosphere, is closely associated with the fourth (the underlying surface). The last two will actively influence the first two; the cycle of forward and reverse radiation will be changed and the process of atmospheric circulation will be disrupted.

The whole picutre of the climate-forming process is of considerable scientific importance. The investigation of the whole problem must not be based on the determination of various conditions of these meteorological elements and climatic phenomena but on a comprehensive study of the combination of these elements and their interaction and that of the city and its atmosphere.

Past experimental data must not be discarded but used for comparison with new facts obtained from further study.

The contemporary large city cannot be studied by merely evaluating its magnitude in area defined by administrative limits. This area is, physically, considerably greater since the city's surface is made up of an immeasurable number of planes horizontally and vertically oriented and forming various correlations in the system: street-to-wall, roof-to-wall, yard, etc., which, in the final analysis, doubles the surface area with regard to an average two-story structure and triples it with regard to a three-or four-storied structure. In the case of a city like Moscow, its area must be increased two and one-half times, that of Leningrad must be tripled, while for greater Moscow, the coefficient of 3.5 must be used.

The problem of determining the effect of a city's reflected energy on the atmosphere should be presented as the problem of an underlying surface. There is practically no data on this problem. Along with the above, the physical qualities of the underlying surface must be studied. The study of heat expenditure, reflected radiation, etc., is connected with this.

Only a general outline of these new problems in the field of the study of city hygiene is presented here. There are data showing that insignificant but periodically recurring changes and fluctuations in a city's climate (changes often of an unusual character) effect the health of the inhabitants. The comparison of microclimatic factors with the population's health statistics and with the various physiological and pathological changes, in a collective sense, is a new task in hygiology. All of the collected data must be applied when plans for the construction of new populated areas are drawn up.

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